Abstract of the Disclosure

An apparatus and method photochemically converts a first hydrocarbon into at least one other hydrocarbon, such as the conversion of methane to ethane and other higher hydrocarbons. The first hydrocarbon is injected through a high-temperature nozzle into a first reaction chamber surrounded by a first array of optical parametric oscillator/lasers (OPOLs). The secondary radiation of the OPOLs is directed into the first reaction chamber and dissociates the first hydrocarbon into the at least one other hydrocarbon. For the conversion of methane to ethane, the secondary radiation of the OPOLs is preferably within the region of approximately 3.0 microns. In a recirculating stage, residual first hydrocarbon released from the first reaction chamber is circulated through a second reaction chamber surrounded by a second array of optical parametric oscillator/lasers (OPOLs) to further dissociate the residual second hydrocarbon into the at least one other hydrocarbon. The higher hydrocarbons, such as ethane, are removed and collected by distillers after being released from each reaction chamber.